

DEVELOPMENT OF ONLINE-PROBLEM BASED LEARNING MODEL IN STATISTICAL METHOD COURSE

G.A. Mahayukti* and I M. Suarsana
Ganesha University of Education, Indonesia
gustiyamahayukti@gmail.com

Abstract

This study aims to produce a valid and effective Online-Problem Based Learning (Online-PBL) Model in Statistical Method Course. Research and development, which consist of four stages: pre-investigation, design, realization/construction, testing/evaluating & revision, was implemented in this study. The developed Online-PBL Model was judged two expert and a user and was tested against 15 students of Statistical Method Class in Department Mathematics of Education, Faculty of Mathematics and natural Science, Ganesha University of Education. The results of the analysis were: (1) based on the evaluation of the expert and the user, the Online-PBL has been developed was valid, (2) the Online-PBL Model was effective to increase students' learning outcome.

Key words: Problem based learning, online learning, Statistical Method

INTRODUCTION

In the report of The International Commission on Education for the Twenty-first Century (Learning: the Treasure Within), UNESCO, there are 17 declaration items for a Higher Education to do its functions in the twenty-first century (Delors, 1998). Of the them is the item related to “Teacher in search of new perspectives” that emphasizes the importance of presenting real context in learning” in which “the world comes into the classroom”.

Making real context as learning context is one of the strategic steps to address the concern of the increasingly vast gap between learning material in campus and the community needs. Furthermore, in the principle of active learning in college (DBE, 2007), it is stated that the best learning for students is by doing, by using all their five senses, and by exploring their context that consists of people, things, places and events that take place in real life. This strengthens the importance of presenting real world problems in college learning as a must to meet the increasingly more complex challenge of the era.

One of the innovations in learning is Problem Based Learning (PBL). PBL is a learning in which students solve authentic (real world) problems with the aim of structuring their knowledge, developing inquiries and high order thinking skill, developing autonomy and self-confidence (Arends in Trianto, 2007), Chagas (2012) states: “PBL is not to provide students the opportunity to solve problems but rather, the opportunity to perform meaningful learning based on the resolution of problems”. PBL will condition the student not to be trapped in a narrow minded solution, but, on the contrary, it conditions us to see a wider range of open options.

PBL is believed to be the solution to problems faced in the Statistical Method course. Based on observations two major problems occur in this course. First, an indication that there is discontinuity between learning materials and real problems faced by the students, especially in relation to the writing of final project (thesis). The students face problems in selecting and using an appropriate statistical methods for the type of research they are proposing. This indication is confirmed by the tendency among the students to select classroom action research since they think it does not need complex statistics. Secondly, there is an indication that

the students are unable to develop knowledge that they get from the course by themselves. They fail to solve real problems that call for self-development from the learning materials that they get from the lecture. Lectures do not give an impression to the students about learning how to learn. The belief that PBL can bridge the gap between theory and practice and that it has other advantages such as enhancing critical and reflexive thinking skill, long life thinking skill, self-directed learning skill, collaborative learning skill, metacognitive learning skill and communicative skill, both verbal and nonverbal (Rusman, 2010).

Apart from the numerous advantages of PBL, Warmada (2004) says that one of the weaknesses in implementing PBL in the traditional classroom (face-to-face) is the limitation of infrastructure and facilities to support cooperation, communication and search of information and this problem can be solved by applying PBL based on information and communication technology (ICT). Along with the ICT rapid development and the increase in the easiness of accessibility and comfort as well as the low cost of getting knowledge in this field through the internet, then there is an ample opportunity in implementing e-learning. E-learning can provide a virtual context to overcome the limitations as stated by Angelaki & Ilias (2013:78) that ICT development (with the presence of Learning Management System such as moodle) has enabled the facilitation of communication, cooperation, dialogs, and collaborative learning among students. In addition to being able to overcome the limitations of face-to-face learning, on-line learning turns out to give a positive effect to improving the student's learning motivation and learning outcomes (Fathurohman, 2011; Sjukur, 2012) and it can also create a fun learning condition and develop self-confidence (Foss, et al, 2013).

Overcoming the limitations of the traditional PBL by integrating it with online-learning will bring about some advantages which include the formation of learning community, the creation of more intensive communication (since the students are free from social norms (social pressure)), and enabling an easy, quick and varied access to information and knowledge (Savin & Baden, 2007). Furthermore, Chagas (2012) proves that when PBL is implemented in the on-line context, it becomes a pedagogic strategy that is capable of making vivid students' interaction, collaboration, discussion and participation. And the most important thing is the student gives very positive response to the implementation of PBL in the online context (Tomaz, 2013). PBL in the online learning context will provide choices for students on what, when, and how they learn. Hence, they will learn how to learn and will become continual learners. Hence, the integration of PBL and the use of ICT in learning will strengthen their respective advantages.

In this study the integration of the two was designed as a PBL with online setting model. Chagas (2012) states: "PBL in an e-learning context is not significantly different from PBL in a classroom setting. However, it requires specific tools enabling group synchronizations, document management, discussion and task assignment in order to engage students in group investigation as required in PBL activities". In short, the PBL with online setting model is associated as PBL that is traditionally designed as a face-to-face activity that is modified by moving the learning context to the online setting. The PBL with online setting model is also an answer to the many criticisms against the implementation of online learning that is thought to focus on technological design only which is different from a pedagogic design. Hence, this study was aimed at developing PBL with online model together with valid and effective learning instruments to conduct Statistical Method course.

RESEARCH METHOD

This study was a developmental research that referred to Plomp's developmental model. As what is stated by Plomp (1999), the implementation of the development consists of some phases: 1) pre- investigation phase; 2) design phase; 3) realization/ construction phase; 4) testing, evaluating & revision phase and 5) implementation phase. This study was conducted at Mathematics Education Department, Faculty of Mathematics and Natural Sciences, Ganesha

University of Education in 2014. The data that were collected consisted of the data that are shown in the following table.

Table 1. Types of Data , Techniques and Instruments of Data Collection

| No. | Technique | Instrument | Data collected |
|-----|------------------|---------------------------|------------------------------------|
| 1. | Expert Judgement | Validation sheet | Problem validation |
| 2. | Test | Learning achievement test | Student's learning achievement |
| 3. | Observation | Observation sheet | Quality of PBL with online setting |
| 4. | Interview | Interview guide | Supporting information |
| 5. | Non test | Questionnaire | Student's response |

RESULT AND DISCUSSION

Result

The development of PBL with online setting model together with its learning instruments was done by referring to Plomp's developmental model. The result of the development of each phase is as follows.

Result at Pre-Investigation Phase

It is still rare that real world problems become the context of learning and there is an indication that the students are unable to develop knowledge that they get from the lecture by themselves. Based on a review of literature it is believed that PBL as a problem solver in Statistical Method lecture is based on the major advantage of PBL , that is, it can bridge the gap between theory and practice , and other advantages which include its capability to enhance critical and reflexive thinking skill, long life learning skill, self directed learning, collaborative learning, metacognitive thinking skill, and communicative skill, both verbal and non verbal. However, the weakness of PBL in the traditional (face-to-face) classroom is the limitation of infrastructure and facilities to support cooperation, communication and search for information.

Result at Design Phase/ Designing

In principle, the design of PBL with online setting was not different significantly from that of PBL in the face- to- face setting. The design was made in lecture phasing, program mapping, LOM (learning Object Material) development and scheduling. LOM here is a web module and problems scenario as well as e-learning tool needed for the PBL activities to become more optimal in the virtual learning context.

The phasing of the lecture was done based on the topic rather than the meeting (week). Then, a program map was made for each topic that described sources and learning activities that the student had to do in learning the topic (see figure 1).

The next step is to develop LOM in the form of scorm based web module and problem solution. The advantage of this web module is that student's activity output is obtained in reviewing the module in the form of time log and formative test score. Problem sheet is fitted to the forum discussion activity so that the student's contribution in problem solving activity can be traced through responses in the online discussion. (See figure 2)

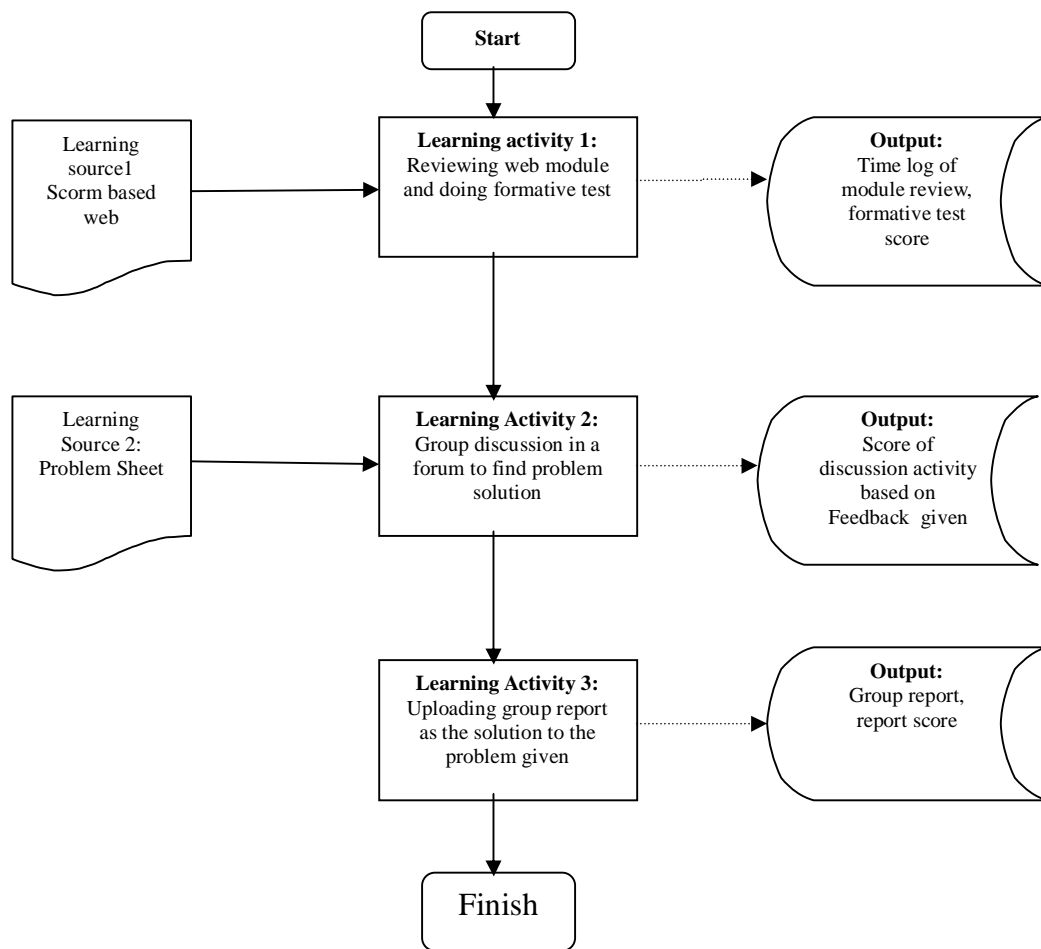


Figure 1: Program Map for Each Topic of the Lecture

Topik 6: Analisis Varians

Topik 7: Analisis Regresi Linier Sederhana & Analisis Korelasi

Lakukan aktivitas belajar berikut secara urut untuk membantu anda memahami materi tentang Analisis Regresi Linier dan Analisis Korelasi secara mandiri

 **Aktivitas 1: Modul Analisis Regresi Linier Sederhana**

Pahami isi modul dengan seksama! Kemudian jawablah **tes formatif** pada bagian akhir modul. Skor anda akan tersimpan pada sistem.

 **Aktivitas 2: Modul Analisis Korelasi**

Pahami isi modul dengan seksama! Kemudian jawablah tes formatif pada bagian akhir modul. Skor anda akan tersimpan sistem.

Diskusikanlah permasalahan yang diberikan secara berkelompok. Tanggapan dan komentar dalam diskusi akan mendapat **skor yang tersimpan pada sistem**. Oleh karenanya, tanggapan yang diberikan jangan mengulang yang telah disebutkan sebelumnya atau copy paste dari sumber lain, tetapi tanggapan yang melengkapi/mengulas tanggapan yang sebelumnya akan lebih dihargai.

 **Aktivitas 3: Diskusi Kelompok**

 **Aktivitas 4: Upload Laporan Lengkap**

Silakan upload laporan kelompok anda pada tautan di atas. Masing-masing kelompok cukup upload sebuah laporan

Figure 2: Preview of Learning Activity

Result of the Realization /Construction Phase

In this phase the realization of PBL with online setting design together with the supporting contents are produced. Please check at <http://suarsana.mdl2.com/course/view.php?id=3> for further information. The login, obviously, can only be done after you have been registered as a course member.

Result of Test/Evaluation and Revision Phase

The first draft of PBL with online setting produced was then validated through expert judgement. The validation was done for every problem scenario and online learning design. The scenario validation was done by paying attention to the criteria of PBL problems from Taupiq (2009) and a very valid problem qualification was obtained. While the design validation of the online learning was done by using the criteria of ISO 19796-1 based e-learning quality developed by Cahyani et al (2010) and a good qualification was obtained. Then, this prototype was tried out to the students who took Statistical Method in Class A in the even semester in the academic year 2013-2014 with the total of 15 students. The try-out was done to find out the students' activities in learning, the students' learning achievement, and the students' response to the implementation of the model and average scores of 82.7 (B), 86.3 (very active) and 76.7 (positive) were obtained for learning achievement, activity in discussion forum and student's response respectively. The students also gave inputs in relation to the advantages and weaknesses of the lecture using PBL with online setting model. Some advantages according to the students were 1) it can train the student how to learn individually, 2) it can train the student how to solve real problems in the field, 3) it is fun and integrates technology in the lecture, 4) it motivates the students to be active in the discussion, and 5) a lecture should not always be face-to face. Some weaknesses that they also express were 1) very dependent on the internet connection, 2) the online discussion is difficult to follow and 3) why should we discuss online while we can see each other directly.

Discussion

The development of PBL with online setting model together with its valid and effective learning instruments to conduct Statistical Method course has been started from the preliminary investigation, design, realization/construction and testing/evaluation and revision phases. In this study the implementation phase has not been done due to the limitation of time. At the pre- investigation phase, were identified the problem in Statistical Method course, i.e., it rarely uses real world problems as learning context. This has an effect on the emergence of a gap between theory and practice in the field. Based on the study done a step for finding a solution to the problem in the form of the development of PBL with online setting model was designed. This was based on the fact that PBL always makes real problems as points of departure in learning. According to Rusman (2010), PBL is able to enhance critical and reflexive thinking, lifelong education, self directed learning, collaborative learning, metacognitive thinking, and communicative skill, both verbal and nonverbal. However, the weaknesses of PBL implementation in the lecture in traditional (face -to- face) classroom are the limitation of infrastructure and facilities to support cooperation, communication and search of information that can be solved by implementing PBL based on Information and Communication Technology (Warmada, 2004)

Then, at the design phase, a design was made for lecture phasing, program mapping, LOM development and scheduling (Muharik, 2010) . PBL with online setting was designed based on moodle. Moodle is an LSM open source that can be obtained free of charge. The use is easy and can be modified according to the needs. The teacher does not need to be proficient in web programming to be able to use it so that the time can be used to think of the learning contents (Surjono, 2009). Jati's (2009) finding shows that 67% of public universities and 100% of private universities that use e-learning system use moodle as its LSM.

The next step was phase realization, i.e., the construction of PBL with online setting as

an integrated online course. Here what is meant by integrated is that in the course the system is not only used to store contents but it is also used to record every activity of the student during login in the database. The course was designed for 16 meetings with 8 topics. In every topic the student was obliged to do some activities of learning in the form of reviewing web module, answering formative test questions in the module, discussing problem sheet in group through online forum and uploading group report using a predetermined link. According to Mertasari (2010), learning activities that are done online will guarantee student's control, flexibility, context freedom and they are also relatively free from social convention. It is this that will encourage the development of student's self-learning.

The realization of the online PBL was then considered as a draft. This draft was then validated through testing/evaluating and revision phase. The validation was done for problem sheet and PBL Online. The result of validation of the problem sheet used fell into very valid category. The written comments by the two validators were: 1) the need to write a guideline in the problem sheet for obtaining sources of material and 2) a clear instruction concerning the details of the report expected from the student. The evaluation of PBL Online was carried out by an experienced e-learning developer and a lecturer of Statistical Method as a user. The result of the two judges fell into good category. The comments from the expert user for correction were : 1) that an evaluation of the learning outcome of each material needs to be done more than once and 2) that a short guideline needs to be written for the student and the lecturer who will use PBL Online.

Based on the comments from the expert and user then a revision of PBL online was done and then it was tried out in a small group that involved 15 students. The try-out was done for a topic of the lecture. The result of module reviewing and formative test taking shows an average score of 82.7 (B). The result of tracing student's activity in online discussion also shows that it contributes positively by giving opinions for problem solutions. This is in line with Savin & Baden's (2007) who state that the advantages of PBL in online context, among others, are the formation of a productive learning community, a discussion that is free from social pressure so that the communication becomes more intensive as to facilitate in reflecting and reviewing the student's contribution. This result gives more support to the result of Fathurohman's (2011) study and Sjukur's (2012) that online learning has given a positive effect on enhancing learning motivation and learning outcome among students. The result of student's response to PBL with online setting implementation in Statistical Method course was positive. The students as users could accept the innovation in learning done. They wrote that PBL Online has advantages of training self-learning. This is the same as Tomaz's (2013) finding that students respond very positively to PBL implementation in online context.

On the whole, through this study PBL with online setting model has been developed for Statistical Method course together with its instruments which meets validity criterion. However, the try-out done was still in a small group that, obviously, cannot be generalized to a larger population. In order for it to meet the criterion of feasibility it needs further try-outs empirically in a larger population.

CONCLUSION AND SUGGESTION

PBL with online setting model together with its instruments developed for Statistical Method has met the criteria of validity and effectiveness. The problem sheet developed has met

PBL problem characteristics. PBL with online setting model based on moodle that was developed has also met the criterion of validity and the small group try-out was effective in enhancing achievement and student's learning activity. The students as the users also responded the PBL Online implementation positively in Statistical Method course. Making real world problems as the context in learning is a must to ascertain our students can meet the challenge of the era that is increasingly more complex. In addition, as lecturers/ students are living in an era with a very rapid ICT development. Substituting face-to - face meeting for online learning has to be able to cover up the weaknesses of face-to-face learning, not the reverse.

REFERENCES

- Angelaki, c. dan Ilias M. 2013. Communication and Social Presence: The Impact on Adult Learners' emotions in distance learning. *European Journal of Open Distance and e-Learning Vol 16 No 1*.Page78-93
- Cahyani, A.D. dkk. 2010. Penggunaan *nalytical Hierrachy Process* dalam Penilaian Kualitas Sistem E-Learning Berbasis ISO 19796-1. *Jurnal Ilmiah Kursor*Vol 5 No 4. Hal 238 - 245
- Chagas, I. et al. 2012. *Problem Based Learning in an Online Course on Healt Education*. Diakses <http://www.ie.ul.pt> pada tanggal 10 Pebruari 2013
- DBE. 2007. *Pembelajaran Aktif di perguruan Tinggi*. ALFHE: Jakarta
- Delors, J. 1998. *Report to UNESCO of the International Commission on Education for the Twenty-first Century (Learning: The Treasure Within)*. Paris: UNESCOPublishing
- Fathurohman, A. 2011. Pengaruh pengembangan Model Pembelajaran E-learning Terhadap Prestasi Belajar Mahasiswa fakultas Kedokteran Universitas Muhammadiyah Semarang. Tesis (Tidak diterbitkan): Unversitas Dian Nuswantoro.
- Mubarik, A. 2012. *Petunjuk Teknis Pengembangan Konten Pembelajaran*. Depok: Digital Library & Distance Learning Lab
- Plomp, T. 1997. *Educational and Training Sistem Design*. Enschede: University of Twente
- Rusman. 2010. *Model-model Pembelajaran*. Bandung: Mulia mandiri Persada.
- Savin, M. dan Baden.2007. *A Practical Guide to Problem Based Learning Online*. New York: Routledge.
- Sjukur, S.B. 2012. Pengaruh Blended Learning terhadap Motivasi dan hasil Belajar Siswa Tingkat SMK. *Jurnal Pendidikan Vokasi. Vol 2. Nomor 3*. Hal 368-378
- Surjono, H.D., 2009. Pengantar E-learning dan Penyiaian Materi Pembelajaran. Puskom UNY
- Taufiq, A. 2009. *Inovasi Pendidikan melalui Problem Based Learning*. Jakarta : Kencana Prenada Media
- Tomaz et al. The Design and program Evaluation of Distributed PBL curriculum for Training Family Doctors in Brazil. *European Journal of Open Distance and e-Learning Vol 16*

No 1.11-26

Trianto. 2009. *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta : Kencana Prenada Media Group

Warmada. 2004.*Problem-Based Learning berbasis ICT*. Seminar .Penumbuhan Inovasi Sistem Pembelajaran Pendekatan Problem-Based Learning berbasis ICT (*Information and Communication Technology*)., 15 Mei 2004